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Peel et al.

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(54) **SHOWERHEAD**

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(73) Assignee: **KOHLER MIRA LIMITED** (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 12/672,729, filed as application No. PCT/GB2008/002703 on Aug. 11, 2008, now Pat. No. 8,876,023.

(30) **Foreign Application Priority Data**

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Mar. 6, 2008 (GB) 0804172.5

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A62C 31/00 (2006.01)
B05B 1/18 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B05B 1/185*** (2013.01); ***B05B 1/1654*** (2013.01); ***E03C 1/0408*** (2013.01); *B05B 15/066* (2013.01)

(58) **Field of Classification Search**
CPC B05B 1/14; B05B 1/18; B05B 1/185; B05B 1/262; B05B 1/1618; B05B 1/1636; B05B 1/1645; B05B 1/1654; B05B 1/1663; B05B 13/0431; B05B 15/065; B05B 15/066; B05B 15/067; E03C 1/0408
USPC 239/390, 393, 443, 446–449, 548, 552, 239/556, 558, 559, 587.1, 587.5, 587.6; 4/605, 615, 567
See application file for complete search history.

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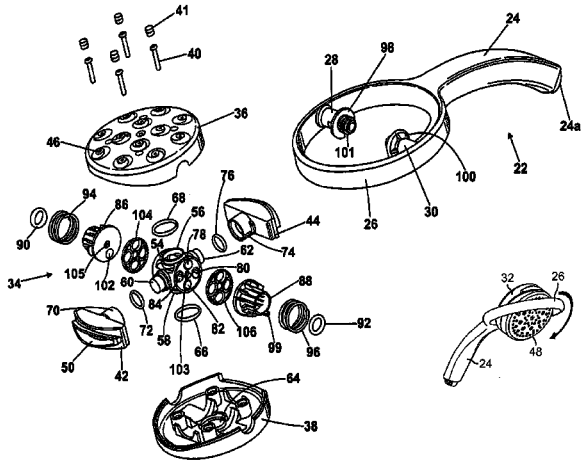
(57) **ABSTRACT**

A showerhead (**20**) has a spray head (**32**) having a plurality of spray outlets (**36**, **38**,**42**,**44**) on different faces is mounted for manual rotation about a single pivot axis both to select a spray outlet and to adjust the direction of the spray for the selected spray outlet. The showerhead can be configured so that flow of water is uninterrupted during changeover between spray modes. Alternative versions of the showerhead are disclosed in which the spray head is mounted for powered rotation, for example by a motor, allowing remote operation of the showerhead.

19 Claims, 15 Drawing Sheets



(51) **Int. Cl.**

B05B 1/16	(2006.01)
E03C 1/04	(2006.01)
B05B 15/06	(2006.01)

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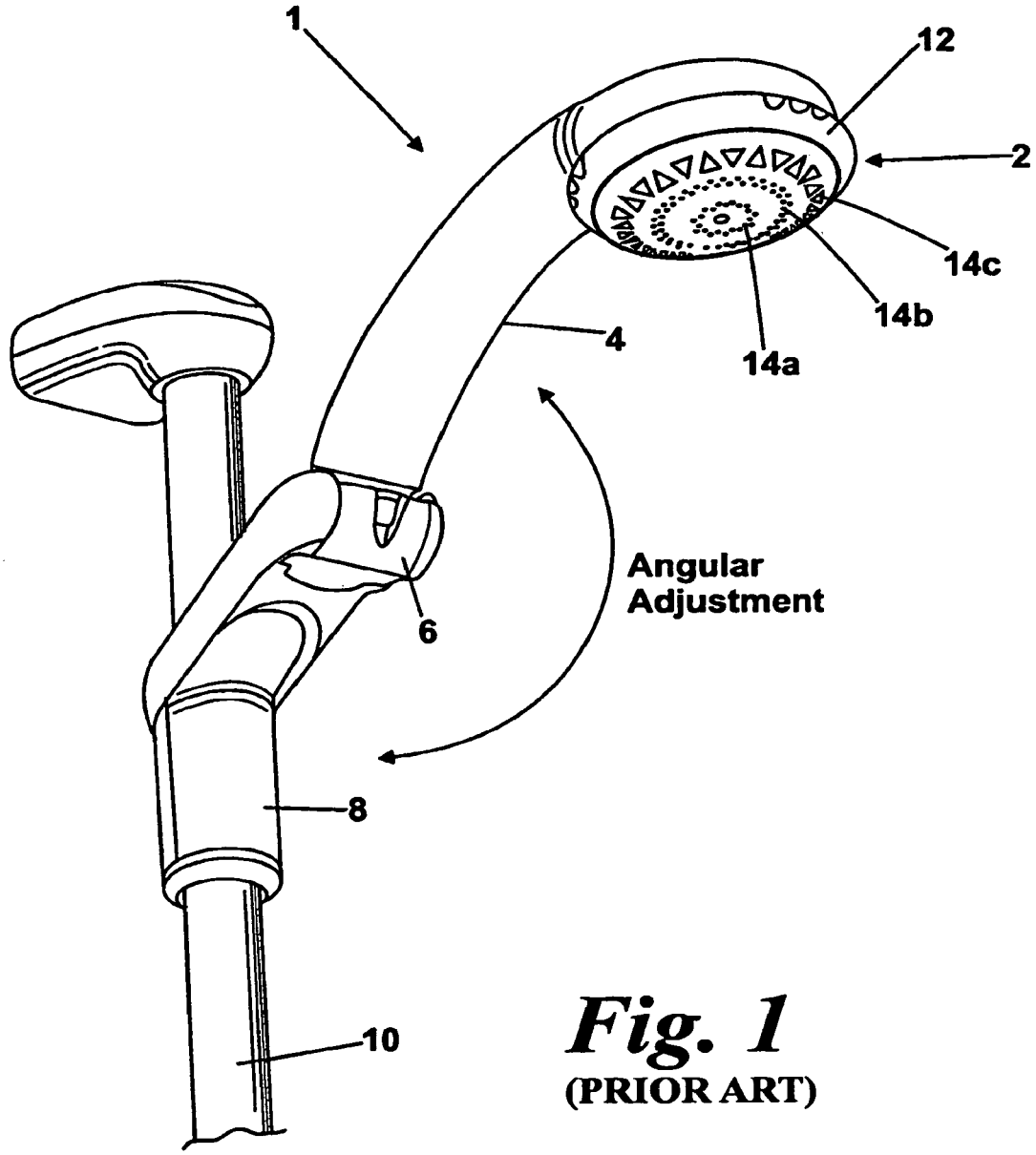

Fig. 1
(PRIOR ART)

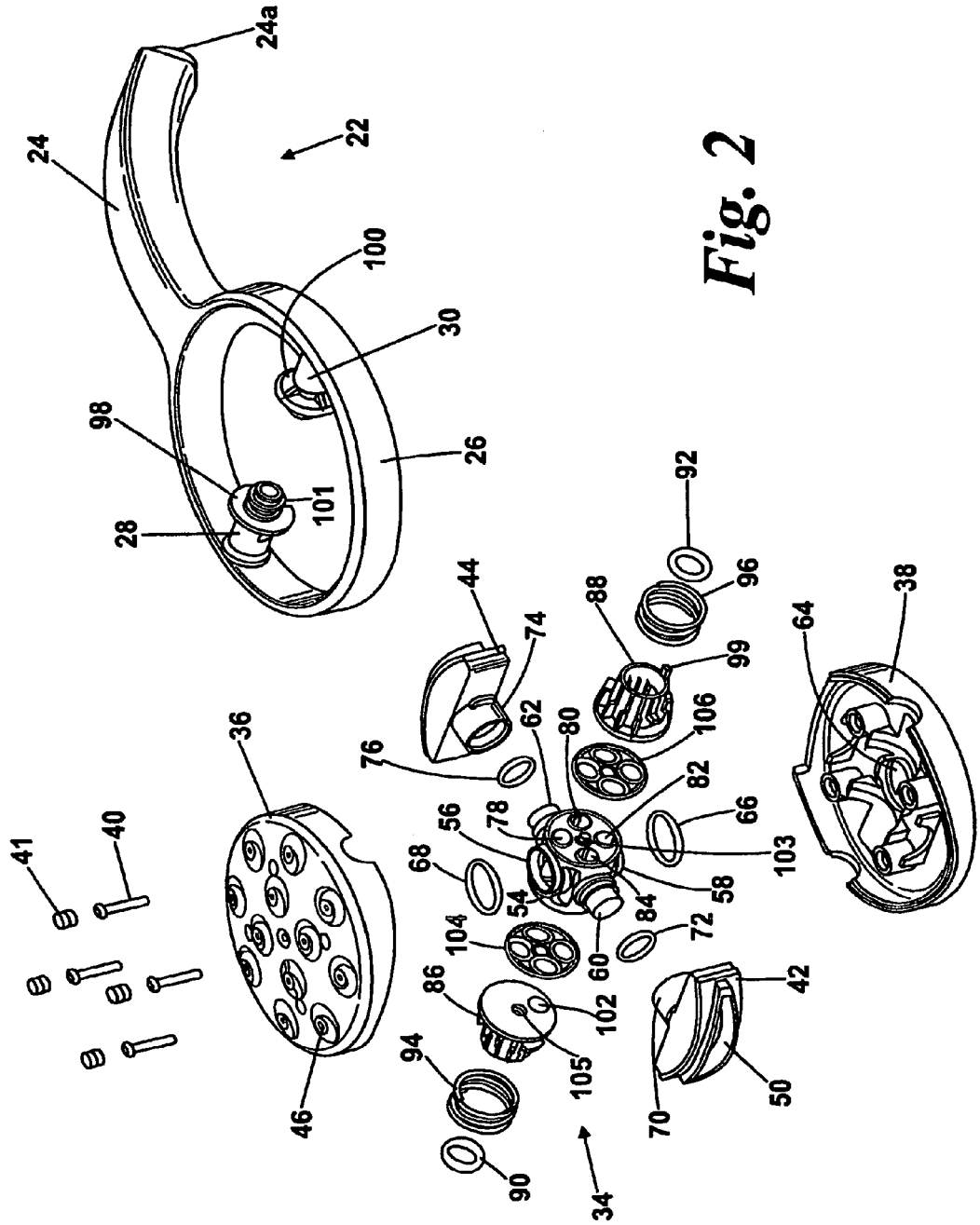
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Fig. 2

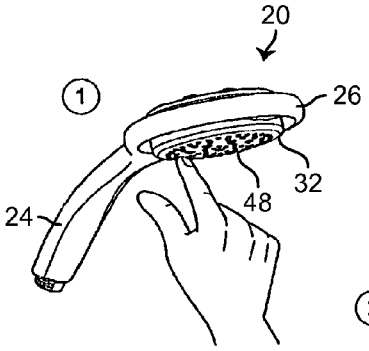


Fig. 3

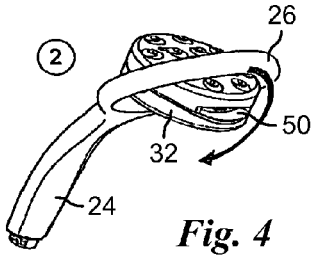


Fig. 4

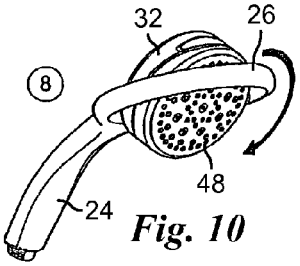
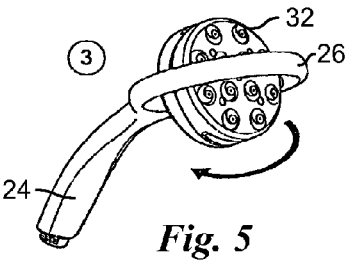


Fig. 10



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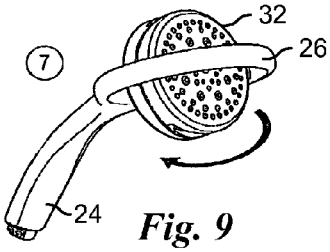

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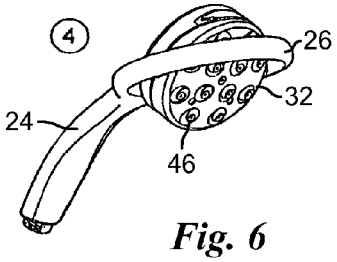

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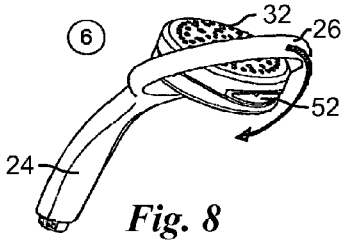

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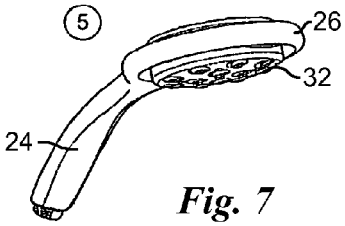

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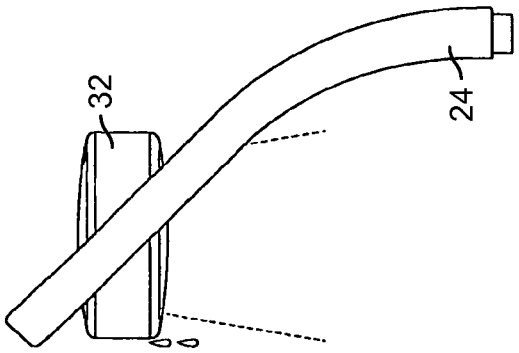

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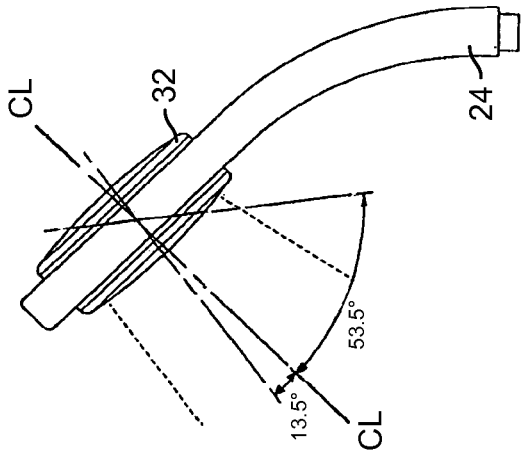

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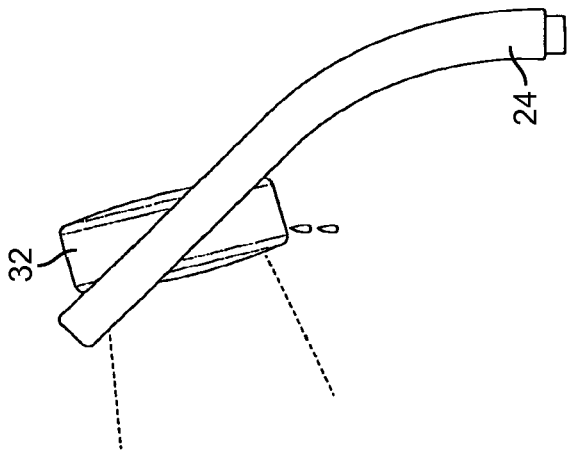

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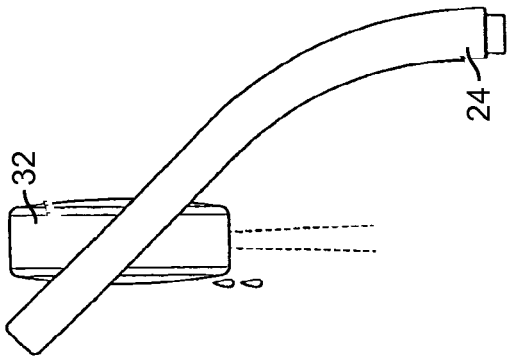

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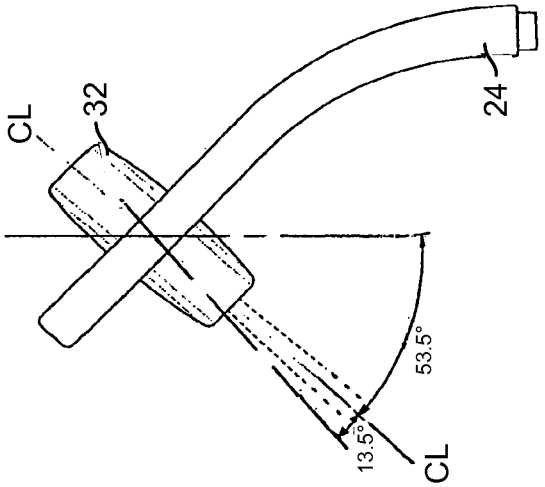

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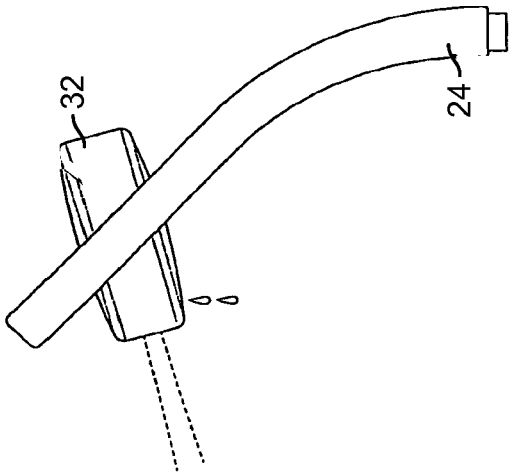

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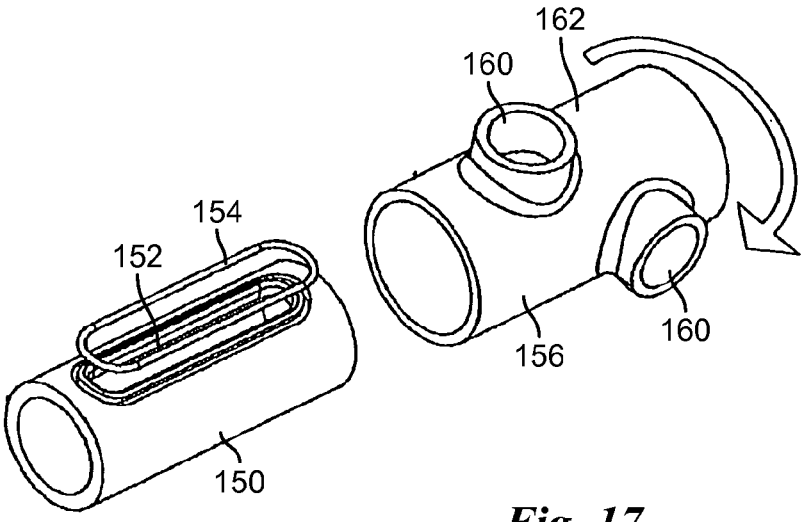

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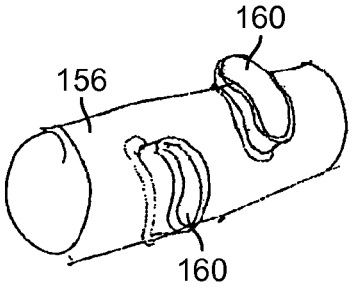

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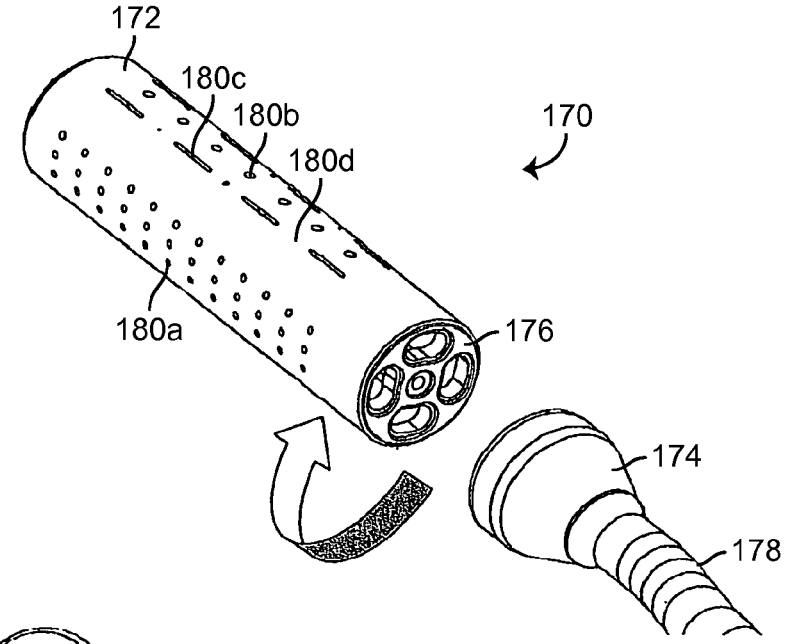
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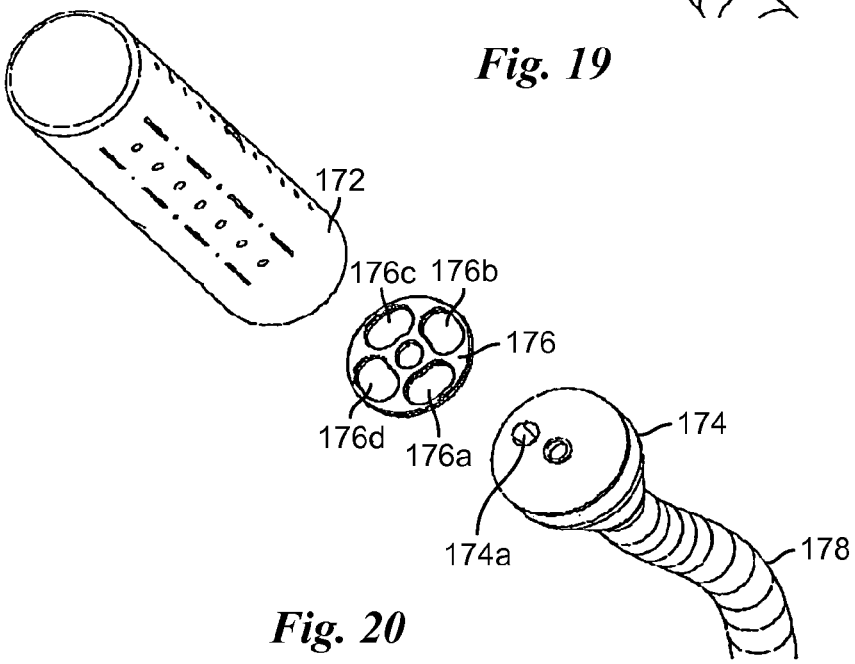
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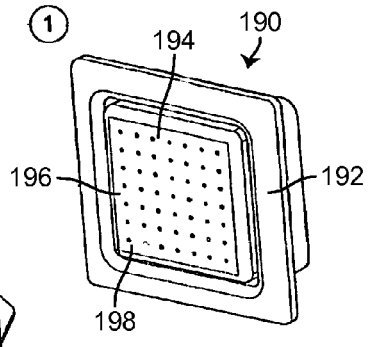

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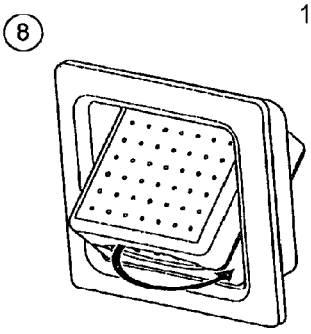

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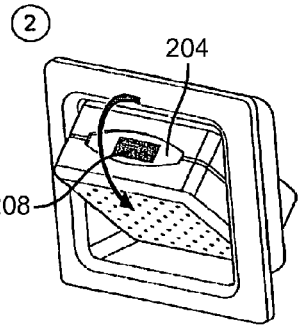

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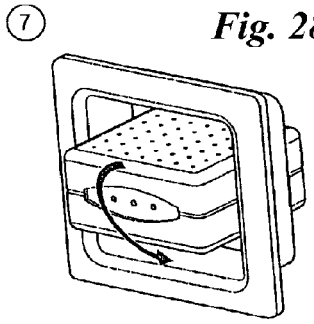

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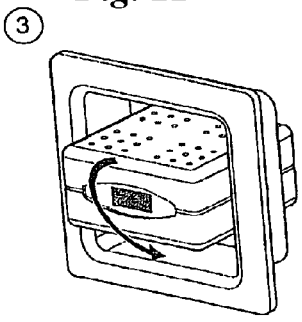

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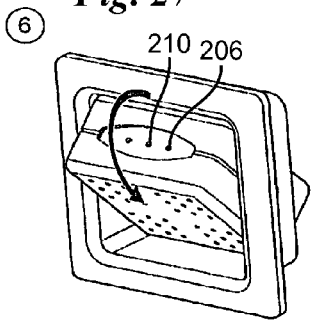


Fig. 26

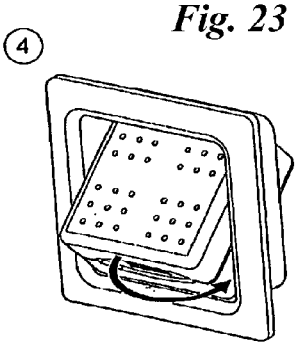
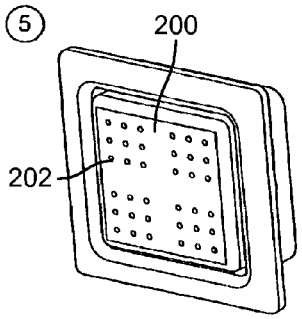


Fig. 24



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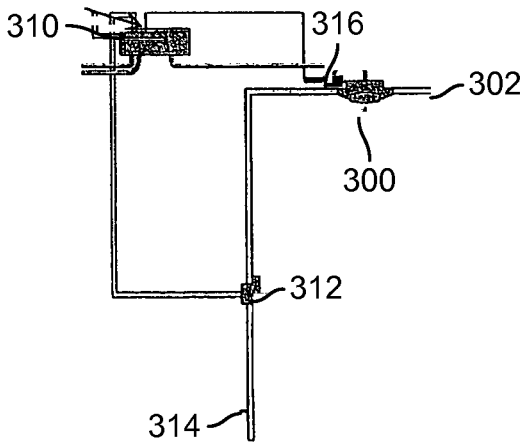

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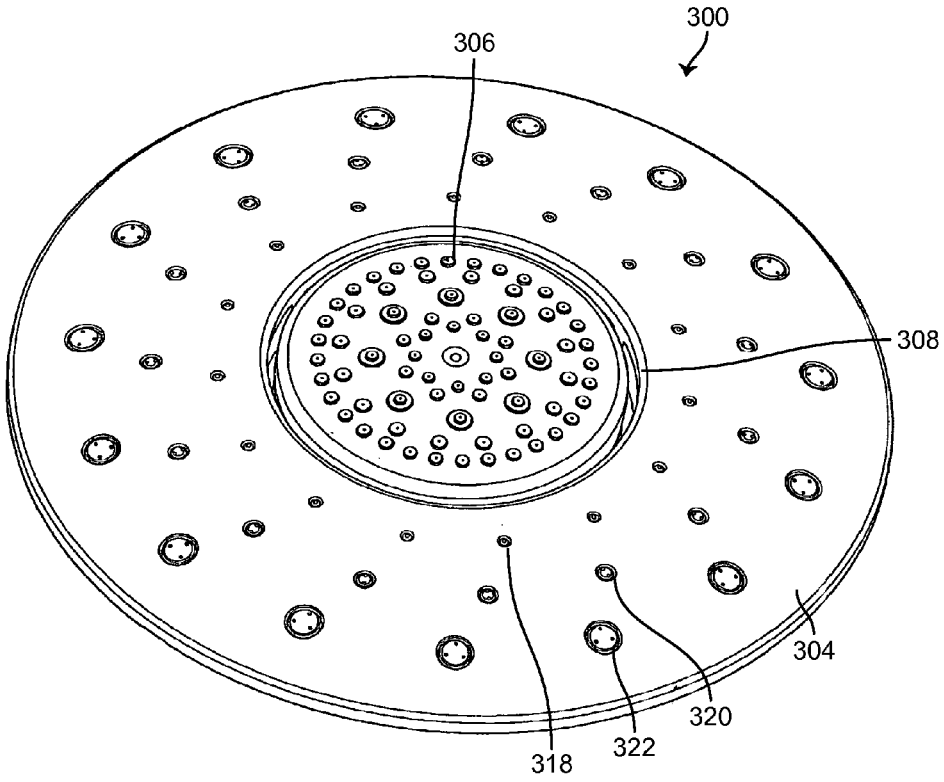

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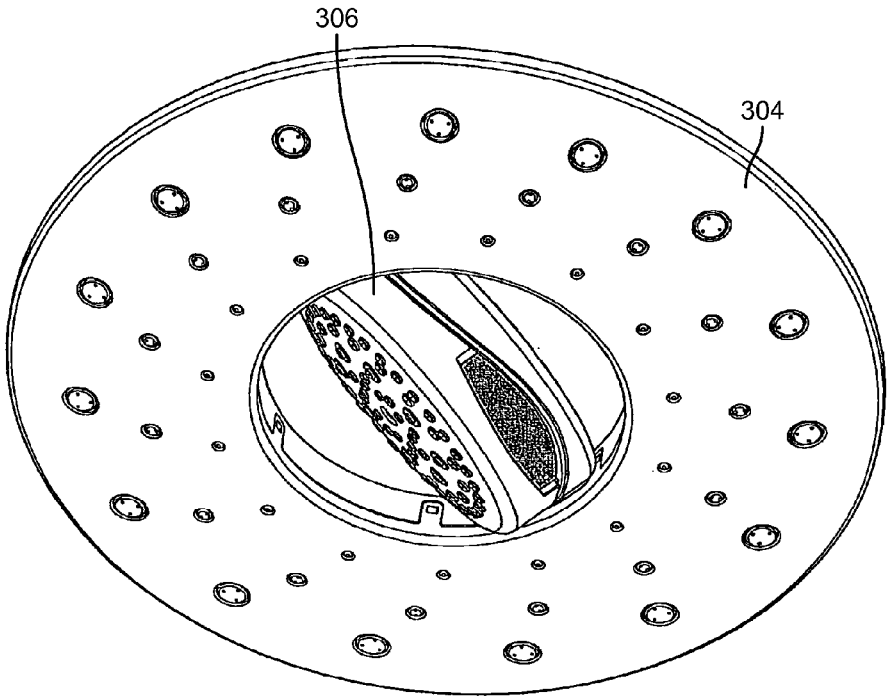

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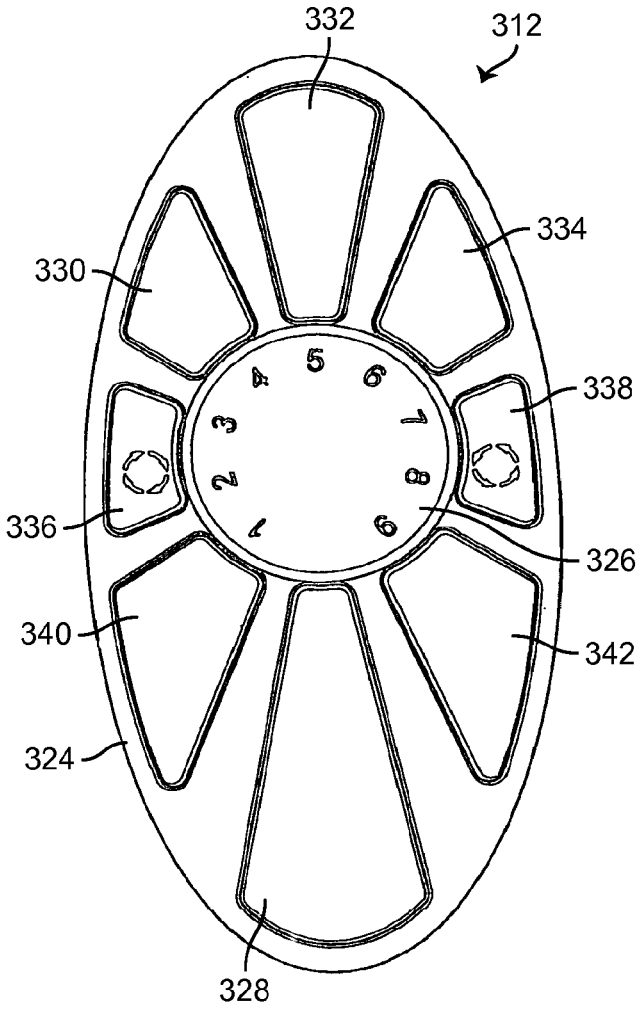

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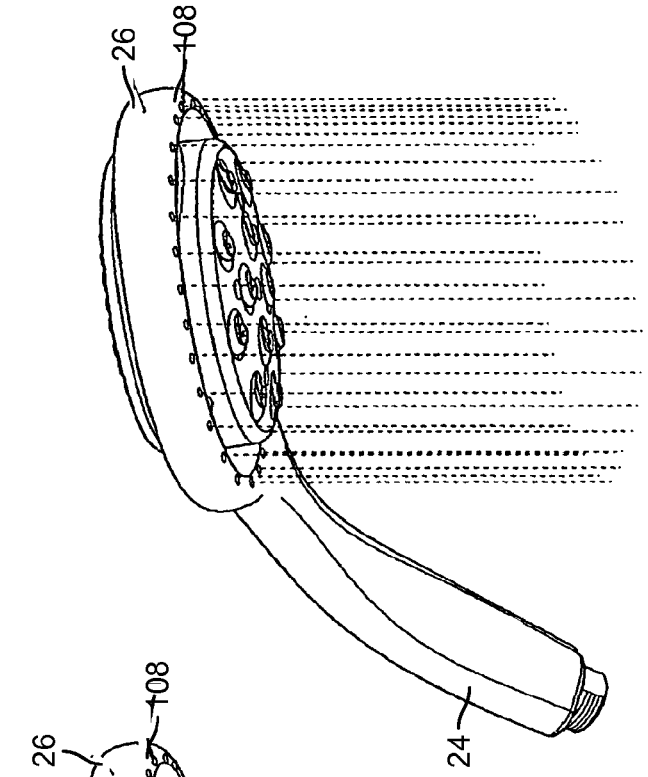


Fig. 34

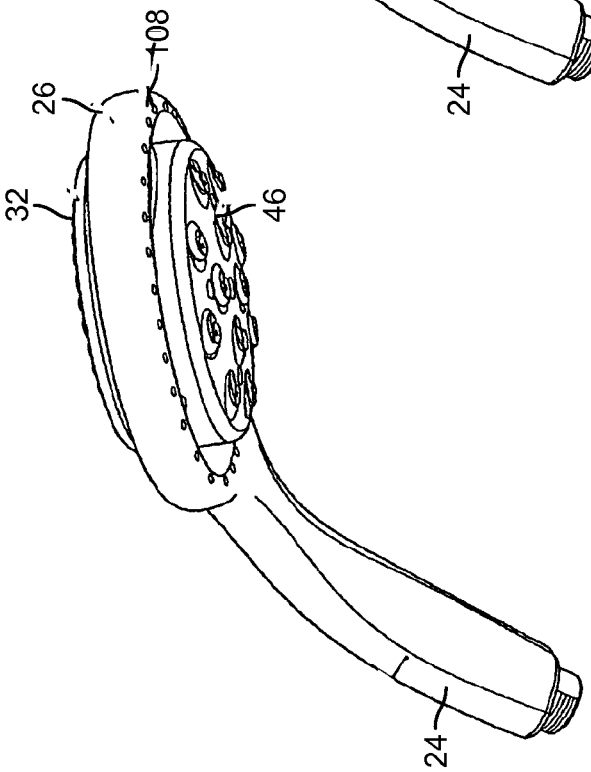
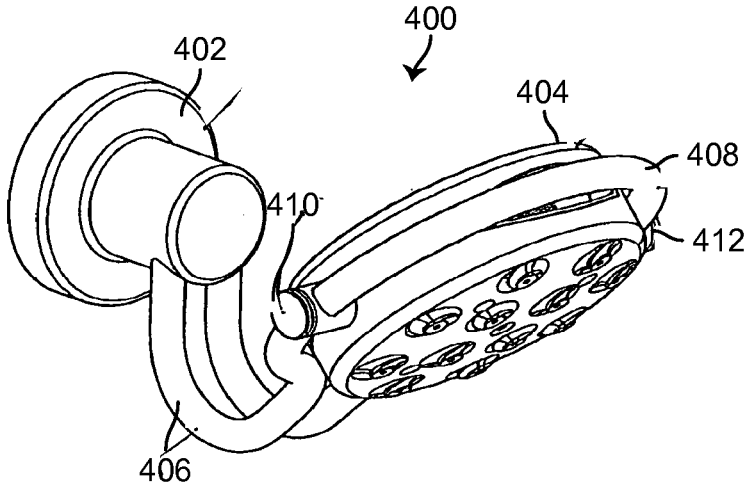


Fig. 33



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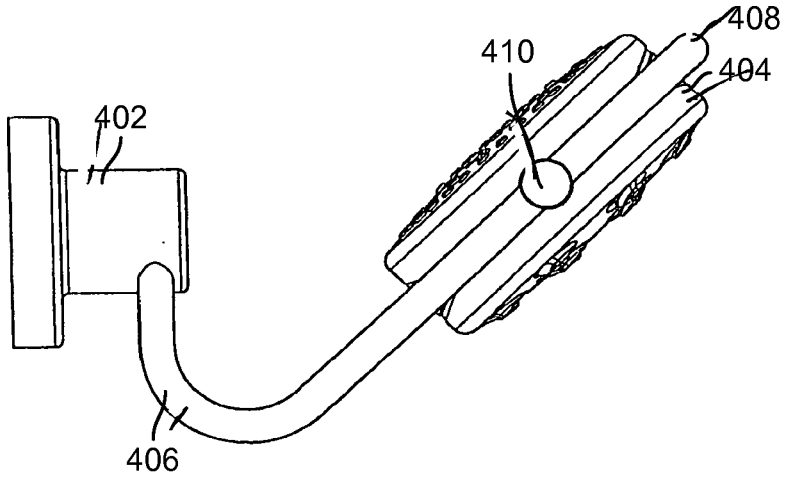

Fig. 36

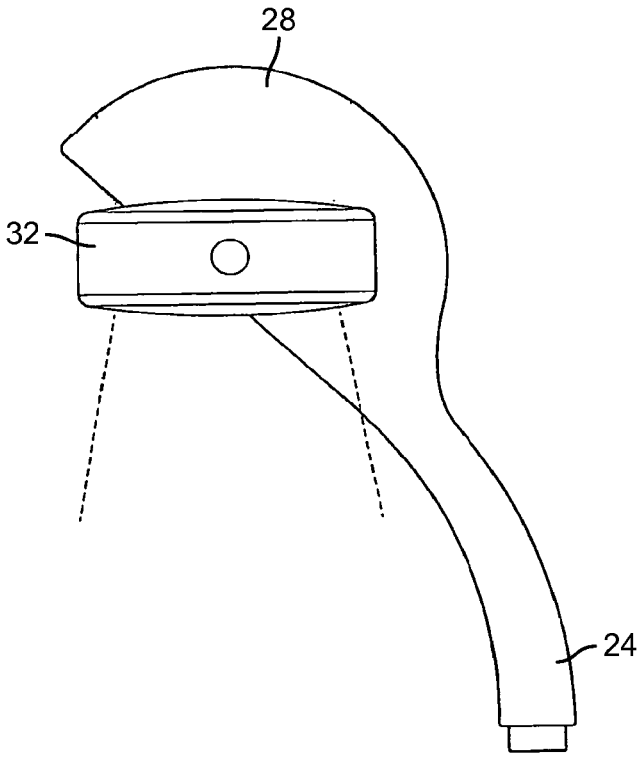

Fig. 37

SHOWERHEAD

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application is a Continuation of U.S. patent application Ser. No. 12/672,729, filed on Apr. 30, 2010 (now U.S. Pat. No. 8,876,023), which is a National Phase entry of PCT Application No. PCT/GB2008/002703, filed on Aug. 11, 2008, which claims the benefit of and priority to U.K. Patent Application No. 0804172.5, filed on Mar. 6, 2008, and U.K. Patent Application No. 0715612.8, filed on Aug. 10, 2007. The entire disclosures of each of the foregoing applications are incorporated by reference.

BACKGROUND

This invention relates to spray fittings and has particular, but not exclusive, application to spray fittings for showering. The invention is described hereinafter applied to showerheads although it will be understood that the invention has wider application and the term "showerhead" is to be construed accordingly.

A common showerhead comprises a handset having a spray head that is adjustable to allow selection of one or more of a number of different spray modes. In a typical arrangement, the handset is mounted on a support bracket that is moveable along a riser rail to adjust the height of the spray head, and the handset is pivotal relative to the support bracket to adjust the direction of the spray for a selected spray mode. With this arrangement, two separate means of adjustment are required, one to change the spray mode and another to change the direction of the spray.

In this known arrangement, the sprays for different spray modes are provided by arrays of spray nozzles in one spray plate, typically concentric annular arrays of spray nozzles. With this arrangement, each array of nozzles is restricted to a specific area of the spray plate with the result that the spray coverage can vary, when changing from one array of nozzles to another.

The present invention seeks to alleviate one or more of the problems and disadvantages of existing showerheads.

It is a preferred object of the invention to provide a showerhead in which the spray mode and the direction of the spray for a selected spray mode can be changed in one operation.

It is another preferred object of the invention to provide a showerhead in which water flow can be maintained when changing the spray mode to alter the spray.

It is yet another preferred object of the invention to provide a showerhead in which a full spray can be maintained while changing the direction of the spray for a selected spray mode.

These and other objects and advantages of the invention are generally achieved according to the invention by a showerhead having a spray head mounted for rotation about a pivot axis both to select a spray mode and to adjust the direction of the spray for the selected spray mode.

By this invention, both the spray mode and the direction of the spray for the selected spray mode can be changed by rotation of the spray head in one operation. Such a showerhead provides improved ease of use and may allow enhanced styling.

Preferably, flow of water is uninterrupted during changeover between spray modes. Uninterrupted flow of the water from the showerhead enables the showerhead to be used in applications where a continuous flow of water is required, for example where the showerhead is supplied with water from an instantaneous water heater or from a combination boiler.

In one arrangement, uninterrupted flow can be achieved by providing an overlap between adjacent spray modes so that, when changing from one spray mode to another spray mode, flow of water is provided through both spray modes. Alternatively, or additionally, uninterrupted flow can be achieved by providing the showerhead with an outlet that is connected to the water supply at least during changeover between spray modes. In this arrangement, flow of water from the spray head can be interrupted during changeover between spray modes of the spray head while maintaining flow of water from the showerhead.

Preferably, the spray head is mounted for rotation about a single pivot axis to select any one of a plurality of spray modes angularly spaced apart in the direction of rotation. Preferably, each spray mode has associated spray discharge means, and the spray head can be rotated for discharging water through the spray discharge means of a selected spray mode and for adjusting the direction of the spray for the selected spray mode. Preferably, the direction of the spray from the spray discharge means in each mode is transverse to the pivot axis of the spray head.

In at least one preferred embodiment, the spray head has two spray modes. The spray discharge means of the two spray modes may be arranged on opposite sides of the spray head. In this arrangement, the spray head may be rotatable through 180° (degrees) to select either one of the two spray modes. Alternatively, the spray discharge means of one of the spray modes may be arranged on one side of the spray head and the spray discharge means of the other spray mode may be arranged on a side edge of the spray head. In this arrangement the spray head may be rotatable through less than 180° (degrees) to select either one of the two spray modes, for example 90° (degrees)

In at least one preferred embodiment, the spray head has three spray modes. The spray discharge means of two of the spray modes may be arranged on opposite sides of the spray head and the spray discharge means of the third spray mode may be arranged on a side edge of the spray head. Alternatively, the spray discharge means of two of the spray modes may be arranged on opposite side edges of the spray head and the spray discharge means of the third spray mode may be arranged on one side of the spray head. In both arrangements, the spray head may be rotatable through 180° (degrees) to select either one of first and second spray modes and through less than 180° (degrees), for example 90° (degrees), from either the first or second spray modes to select the third spray mode.

In at least one preferred embodiment, the spray head has four spray modes. The spray discharge means of two of the spray modes may be arranged on opposite sides of the spray head and the spray discharge means of the other two spray modes may be arranged on opposite side edges of the spray head. In this arrangement, the spray head may be rotatable through 90° (degrees) between adjacent spray modes.

By reducing the angular spacing between adjacent spray modes in the direction of rotation of the spray head, changeover from one spray mode to the next spray mode can be effected without interrupting the water flow and the spray can be confined within a desired spray area. In this way, the spray head is prevented from spraying in all directions in an uncontrolled manner during the changeover between the spray modes. Preferably, the angular spacing between adjacent spray modes without interrupting the flow is in the range 60° (degrees) to 120° (degrees), more preferably 75° (de-

grees) to 105° (degrees) with approximately 90° (degrees) most preferred. If the angular spacing is lower than 60° (degrees), rotation of the spray head to change the direction of the spray for the selected spray mode may be restricted. On the other hand, if the angular spacing is higher than 120° (degrees), rotation of the spray head to changeover between spray modes may cause spraying outside a desired spray area.

Preferably, the spray head includes a spray selection module responsive to rotation of the spray head for directing water flow to the spray discharge means of the selected spray mode. The spray selection module preferably allows each spray discharge means to be supplied in sequence by rotation of the spray head around the pivot axis.

In at least one preferred embodiment, the spray head includes at least one mode with spray discharge means comprising a plurality of holes in a spray plate. In at least one preferred embodiment, the spray head includes at least with mode with spray discharge means comprising a single opening. Preferably, the spray head includes at least one mode provided by a detachable spray cartridge.

Preferably, the spray head is rotatable through 360° (degrees). The spray head may be rotatable in a clockwise direction or an anticlockwise direction. Rotation of the spray head may be manual or powered. For example, the spray head may rotated by a motor, preferably a stepper motor.

Preferably, the spray head is angularly adjustable in each spray mode through an arc including a center position of the spray head to change the spray direction in the selected spray mode. The spray head may be angularly adjustable to either side of the center position in each spray mode. The angular adjustment to one side of the center position may be larger than the angular adjustment to the other side. The angular adjustment below the center position may be larger than the angular adjustment above the center position. Preferably, the range of angular adjustment in each spray mode is the same. The range of angular adjustment in each spray mode may be 50° (degrees) to 80° (degrees).

Preferably, the water flow in the selected spray mode is for the most part unchanged by angular adjustment of the spray head within the range of angular movement. As a result, the spray is largely unaffected and a full spray is obtained throughout substantially the whole range of angular movement of the spray head in the selected spray mode.

Preferably the showerhead includes a support for the spray head. The support may extend around a marginal edge of the spray head. The support may be provided with an outlet that provides uninterrupted flow of water on changing from one spray mode to another spray mode. Flow of water may be provided through the outlet in at least one spray mode. In at least one embodiment, flow of water is provided through the outlet in all positions of the spray head. The outlet may comprise a plurality of holes spaced apart in the support around the marginal edge of the spray head. The support may be configured to confine spray from the spray head within a spray area. The support may be provided by a hollow body through which water is delivered to the spray head.

In at least one embodiment, the showerhead comprises a handset. The handset may be mounted on a bracket and may be detachable from the bracket. The bracket may be fixed to a wall or similar support surface. Alternatively the bracket may be mounted on a riser rail and slidable along the rail.

In at least one embodiment, the showerhead comprises a spray unit for mounting in an opening in a wall, ceiling or similar support surface. The unit may include a spray head rotatably mounted in a support frame that is mounted in the opening so that the spray head is substantially flush with the surrounding surface, for example a tiled surface. The spray head may be manually rotatable or may be rotatable by drive means, for example a motor, especially a stepper motor.

The spray discharge means may be of any suitable type such as one or more holes or slots or a combination thereof. Holes or slots may be arranged randomly or uniformly, for example an annular array. In a preferred arrangement, the spray discharge means of each mode is arranged symmetrically with respect to the pivot axis. In this way, water flow through the discharge means does not exert a rotational force on the spray head such as may cause the spray head to move from its set position.

According to a second aspect of the invention there is provided a showerhead having a spray head mounted for rotation about a single pivot axis both to select any one of a plurality of spray modes angularly spaced apart in the direction of rotation and to adjust the direction of the spray for the selected spray mode, wherein flow of water is uninterrupted during changeover between spray modes.

Preferably, the spray head includes at least two spray modes having spray outlets disposed substantially perpendicular to each other and to the pivot axis of the spray head. More preferably, the spray head has four spray modes with outlets of adjacent spray modes disposed substantially perpendicular to each other and to the pivot axis. In a preferred arrangement, the outlets of two of the spray modes are arranged on opposite sides of the spray head and the outlets of the other two spray modes are arranged on opposite side edges of the spray head.

According to a third aspect of the invention there is provided a showerhead having a spray head mounted for rotation about a single pivot axis both to select any one of a plurality of spray modes angularly spaced apart in the direction of rotation and to adjust the direction of the spray for the selected spray mode, wherein adjacent spray modes in the direction of rotation have outlets arranged at an angle of less than 180° (degrees) to each other.

Preferably, the outlets of adjacent spray modes are arranged at an angle in the range of 45° (degrees) to 135° (degrees) to each other, more preferably 60° (degrees) to 120° (degrees) with a range of 75° (degrees) to 105° (degrees), more preferably approximately 90° (degrees) being especially preferred. In a preferred arrangement, the flow of water is uninterrupted during changeover between the spray modes. A particularly preferred arrangement has four spray modes.

According to a fourth aspect of the invention there is provided a showerhead having a spray head with first and second spray outlets arranged substantially normal to each other wherein the spray head is mounted for rotation about a pivot axis substantially normal to each of the first and second spray outlets, wherein the spray head is rotatable both to select either the first spray outlet or the second spray outlet and to adjust the direction of the spray for the selected spray outlet.

By this arrangement of the first and second spray outlets, changeover from one spray outlet to the other spray, outlet can be effected without interrupting the water flow and the spray can be confined within a desired spray area. In this way, the spray head is prevented from spraying in all directions during the changeover between the spray outlets.

Preferably, the direction of the spray is adjustable over a range of angular movement of the spray head and a full spray is obtained throughout substantially the whole range of angular movement. By this feature, the water flow to the selected spray outlet is for the most part unchanged by angular adjustment of the spray head with the range of angular movement and the spray from the spray outlet is largely unaffected.

According to a fifth aspect of the invention there is provided a spray head comprising a water inlet, two or more

spray discharge means, and a spray selection mechanism responsive to rotation of the spray head about an axis for directing flow to a selected one of the spray discharge means, wherein the spray head is rotatable for changing the selected spray discharge means and varying the angular direction of flow from the selected spray discharge means.

The spray head may be incorporated in an ablutionary fitting such as a showerhead, for example a handset.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail by way of example only with reference to the accompanying drawings, wherein

FIG. **1** shows a prior art shower handset installation;

FIG. **2** is an exploded perspective view of a multi-mode showerhead according to a first embodiment of the present invention;

FIGS. **3** to **10** are perspective views the showerhead of FIG. **2** illustrating adjustment of the rotatable spray head to change the selected spray mode;

FIGS. **11** to **16** are side views of the showerhead of FIG. **2** illustrating adjustment of the rotatable spray head to change the direction of spray in each of the spray modes;

FIG. **17** is an exploded perspective view of an alternative spray selection module;

FIG. **18** shows a modification to the spray selection module of FIG. **17**;

FIG. **19** is an exploded perspective view of a multi-mode showerhead according to a second embodiment of the invention;

FIG. **20** shows a detail of the showerhead shown in FIG. **19**;

FIGS. **21** to **28** are perspective views of a multi-mode showerhead according to a third embodiment of the invention and illustrating adjustment of the rotatable spray head to change the selected spray mode;

FIG. **29** is a schematic view of a shower installation employing a multi-mode showerhead according to a fourth embodiment of the invention;

FIG. **30** is a perspective view of the showerhead of FIG. **29** with the rotatable spray head in a selected spray mode;

FIG. **31** is a perspective view of the showerhead of FIG. **30** illustrating adjustment of the spray head to change the selected spray mode;

FIG. **32** is a front view of a control interface for the shower installation of FIG. **29**;

FIG. **33** is a perspective view showing a modification to the showerhead of FIGS. **2** to **16**;

FIG. **34** is a perspective view similar to FIG. **33** showing water flow from holes in the head portion of the showerhead;

FIG. **35** is a perspective view of a multi-mode showerhead according to a fourth embodiment of the invention;

FIG. **36** is a side view of the showerhead shown in FIG. **35**; and

FIG. **37** is a side showing another modification to the showerhead of FIGS. **2** to **16**.

DETAILED DESCRIPTION

Referring first to FIG. **1** of the accompanying drawings, a typical prior art shower handset installation is shown comprising a handset **1** having a spray head **2** at one end of a handle portion **4**. The other end of the handle portion **4** is adapted for connection to a flexible hose (not shown) for delivering water to the spray head **2** via a water supply passageway (not shown) within the handle portion **4**. The end of the handle portion **4** remote from the spray head **2** is detachably located in a parking socket **6** for holding and supporting the handset **1**. The parking socket **6** is pivotally connected to a support bracket **8** moveably mounted on a riser rail **10**.

The support bracket **8** is slidable up and down the riser rail **10** to raise and lower the handset **1** to adjust the vertical height of the spray head **2** and the parking socket **6** is pivotal relative to the support bracket **8** to alter the angle of the handset **1** to adjust the direction of water flow from the spray head **2**. The support bracket **8** can be secured at any desired position along the riser rail **10** by a friction clamp and the parking socket **6** is retained at any desired position relative to the support bracket **8** by a friction pivot.

The spray head **2** typically comprises a number of spray delivery chambers (not shown) that are selectively connectable to the water supply passageway by a valve mechanism (not shown) operable in response to rotation of a control ring **12** of the spray head **2** to direct water to a selected chamber from which the water is discharged through one or more spray nozzles. Three annular sets of spray nozzles **14***a*, **14***b*, **14***c* are shown corresponding to three different spray modes. As will be understood, with the above arrangement, the spray mode selection is obtained by rotation of the control ring **12** at the spray head **2** about an axis parallel to the direction of water flow from the spray head **2** in each mode and the angular adjustment of the direction of the spray is obtained by pivotal movement of the parking socket **6**.

A showerhead in accordance with the present invention is shown in FIGS. **2** to **16** in the form of a handset **20**. The handset **20** comprises a hollow body **22** having a handle or grip portion **24**, and an annular, ring-shaped head portion **26** having a pair of opposed, inwardly directed hollow spigots **28**,**30** on which a spray head **32** is mounted for rotation about a pivot axis transverse to the longitudinal axis of the handle portion **24**. The handle portion **24** has a threaded boss **24***a* at the end remote from the head portion **26** for connecting a flexible hose (not shown) to deliver water to the handset **20** from a source (not shown) of temperature controlled water such as a mixing valve or instantaneous water heater. An internal water supply passageway (not shown) in the handle portion **24** and head portion **26** delivers water to the spray head **32** via the spigots **28**,**30** and a spray selection module **34** located within the spray head **32**. The spray head **32** is rotatable about the pivot axis to select one of four spray modes and to adjust the direction of the spray of the selected spray mode as described in more detail later.

The spray head **32** comprises a pair of annular, spray plates **36**,**38** secured together by a plurality of screws **40**—in this embodiment four screws, although any number may be used—and a pair of spray cartridges **42**,**44** located opposite one another in the side edge of the spray head **32** between the spray plates **36**,**38**. The heads of the screws **40** are received in counterbores in the outer face of the spray plate **36** and concealed by plugs **41** inserted into the counterbores. The plugs **41** may match the finish of the spray plate **36**.

Each spray plate **36**,**38** has an array of holes **46**,**48** respectively through which water is discharged in the form of individual streams forming a desired spray according to the number, type and location of the holes **46**,**48**. Each spray cartridge **42**,**44** has a slot **50**,**52** through which water is discharged in the form of a single stream forming a curtain spray according to the size and shape of the slots **50**,**52**. Each array of holes **46**,**48** is different and each slot **50**,**52** is different providing four different sprays for selection by the user rotating the spray head **32**.

FIG. **3** shows the spray head **32** with the spray mode corresponding to the array of holes **48** in the spray plate **38** selected. The spray head **32** is rotatable from the position

shown in FIG. **3** through the intermediate position shown in FIG. **4** to the position shown in FIG. **5** with the spray mode corresponding to slot **50** in cartridge **42** selected. The spray head **32** is rotatable from the position shown in FIG. **5** through the intermediate position shown in FIG. **6** to the position shown in FIG. **7** with the spray mode corresponding to the array of holes **46** in the spray plate **36** selected. The spray head **32** is rotatable from the position shown in FIG. **7** through the intermediate position shown in FIG. **8** to the position shown in FIG. **9** with the spray mode corresponding to slot **52** in cartridge **44** selected. The spray head **32** is rotatable from the position shown in FIG. **9** through the intermediate position shown in FIG. **10** to return to the position shown in FIG. **3** with the spray mode corresponding to the array of holes **48** in the spray plate **38** again selected. As will be appreciated, the spray head **32** can be rotated in either direction to select the desired spray mode. In this embodiment, the spray head **32** is rotatable through 90° (degrees) between a center position of each spray mode.

The spray selection module **34** includes a central hub **54** having two opposed outlet ports **56**,**58** for delivery of water to the spray plates **36**,**38** respectively and a further two opposed ports **60**,**62** for delivery of water to the spray cartridges **42**,**44** respectively. The ports **56**,**58**,**60**,**62** extend radially with respect to the pivot axis. The ports **56**,**58** are aligned and the ports **60**,**62** are aligned and normal to the ports **56**,**58**.

The spray plate **38** has an inlet port **64** that is sealed relative to the outlet port **58** of the hub **54** by an O-ring **66** and opens to an inlet chamber (not shown) that communicates with the holes **48**. The spray plate **36** has a similar inlet port (not shown) that is sealed relative to the outlet port **56** of the hub **54** by an O-ring **68** and opens to an inlet chamber (not shown) that communicates with the holes **46**.

The cartridge **42** has a tubular inlet port **70** that is a push fit on the outlet port **60** of the hub **54** and is sealed relative to the port **60** by an O-ring **72**. The cartridge **44** has a tubular inlet port **74** that is a push fit on the outlet port **62** of the hub **54** and is sealed relative to the port **62** by an O-ring **76**. With this arrangement, the cartridges **42**,**44** can be detached from the hub **54** and replaced by cartridges having a different water outlet. For example, one or both cartridges may have a slot to provide a curtain spray. Alternatively, one or both cartridges may have an array of nozzles to provide individual sprays.

The hub **54** has four separate axial through bores **78**,**80**,**82**,**84** parallel to and offset from the pivot axis. The bores **78**,**80**,**82**,**84** extend between end faces of the hub **54** and communicate with the outlet ports **56**,**58**,**60**,**62** respectively. The hub **54** is located between the spray plates **36**,**38** and rotates with the spray head **32** relative to the spigots **28**,**30** on the head portion **26**.

The spray selection module **34** further includes a pair of water diverters **86**,**88** mounted on and sealed relative to the spigots **28**,**30** respectively by O-rings **90**,**92** respectively. The diverters **86**,**88** are biased towards the end faces of the hub **54** by springs **94**,**96** respectively acting between the diverters **86**,**88** and flanges **98**,**100** on the spigots **28**,**30** respectively. Each diverter **86**,**88** has a tongue **99** (one only shown) that engages a notch **101** (one only shown) in the flange **98**,**100** of the associated spigot **28**,**30** to locate the diverters **86**,**88** against rotation relative to the spigots **28**,**30**.

The diverter **86** has a port **102** offset from the pivot axis and the diverter **88** has a similar port (not shown) that is aligned with the port **102** in the assembled spray head **32**. The hub **54** has a peg **103** at each end (one only shown) coaxial with the pivot axis that locates in a blind bore **105** (one only shown) of the adjacent diverter **86**,**88** and is rotatable relative to the diverters **86**,**88** in response to rotation of the spray head **32** to select one of the four spray modes in which the bore **78**,**80**,**82**,**84** corresponding to the selected spray mode aligns with the diverter ports **102** (one only shown) to deliver water to the selected spray outlet. A gasket **104** is provided between the diverter **86** and the end face of the hub **54** and has apertures aligned with the bores **78**,**80**,**82**,**84** to provide a seal between the diverter **86** and hub **54** in all angularly adjusted positions of the hub **54**. A similar gasket **106** is provided between the diverter **88** and the opposite end face of the hub **54**.

The diverter ports **102** (one only shown) and hub bores **78**,**80**,**82**,**84** are arranged to permit a range of angular movement of the spray head in the selected spray mode to alter the direction of the spray from the selected spray outlet without overlapping the hub bore of an adjacent spray outlet so as to maintain a full spray from the selected spray outlet. FIG. **12** shows the permitted range of angular movement of the spray head **32** about a center position to adjust the direction of spray from a selected spray plate **36** (or **38**) while maintaining a full spray. FIG. **15** shows the permitted range of angular movement of the spray head **32** about a center position to adjust the direction of spray from a selected spray cartridge **42** (or **44**) while maintaining a full spray. As shown, a full spray is maintained for a range of movement of the spray head of 13.5° (degrees) above a center line CL of the spray plate **36** (or **38**)—FIG. **12**—or spray cartridge **42** (or **44**)—FIG. **15**—and of 53.5° (degrees) below the center line CL of the spray plate **36** (or **38**)—FIG. **12**—or spray cartridge **42** (or **44**)—FIG. **15**—giving a total range of angular movement of the spray head of 67° (degrees) in which a full spray is obtained in each mode.

When the spray head is rotated beyond the permitted range of angular movement for a selected spray outlet, the hub bore of the next spray outlet in the direction of rotation of the spray head **32** starts to overlap the diverter ports **102** before the hub bore of the selected spray outlet clears the diverter ports **102**. As a result, flow of water gradually decreases from the selected spray outlet and gradually increases from the next spray outlet in the direction of rotation until the spray head **32** is rotated sufficiently to position the spray head **32** within the permitted range of angular adjustment of the next spray outlet so that water is discharged from the next spray outlet only. In this way, the flow of water is not interrupted during changeover from one spray outlet to the next spray outlet such that the handset can be used where a continuous flow of water is required to maintain safe operation, for example with instantaneous water heaters or combination boilers. FIGS. **11** and **13** show rotation of the spray head **32** in opposite directions from the position shown in FIG. **12** so that water starts to flow from a spray cartridge **42** or **44** while still flowing from the spray plate **36** or **38**. FIGS. **14** and **16** show rotation of the spray head **32** in opposite directions from the position shown in FIG. **15** so that water starts to flow from a spray plate **36** or **38** while still flowing from the spray cartridge **42** or **44**.

In this embodiment, the range of movement either side of the center line to provide a full spray is 67° (degrees) for all of the spray outlets—spray plates **36**,**38** and spray cartridges **42**,**44**—and there is a range of movement of 23° (degrees) between adjacent spray outlets during which there is flow from both outlets before the flow changes over to provide a full spray from the next spray outlet in the direction of rotation. It will be understood that the range of movement providing a full spray in each mode is exemplary only and that changes can be made thereto within the scope of the invention. For example, angular movement above the center line CL providing a full spray in each mode may be in the range of 5° (degrees) to 20° (degrees), and preferably 10° (degrees) to 15° (degrees) with a range of 13° (degrees) to 14° (degrees),

more especially 13.5° (degrees), most preferred. Similarly angular movement below the center line CL providing a full spray in each mode may be in the range of 45° (degrees) to 60° (degrees), and preferably 50° (degrees) to 55° (degrees) with a range of 53° (degrees) to 54° (degrees), more especially 53.5° (degrees), most preferred. The overall range of movement providing a full spray in each mode may vary from 50° (degrees) to 80° (degrees), and preferably from 60° (degrees) to 75° (degrees) with a range of 65° (degrees) to 70° (degrees), more especially 67° (degrees), most preferred. In general, the range of movement providing a full spray below the center line CL is larger than the range of movement providing a full spray above the center line CL and typically the ratio of the range of movement below the center line to that above the center line is at least 2:1, more preferably at least 3:1 and is most preferably of the order of 4:1.

The range of movement providing a full spray may be the same for each mode but this is not essential and the range of movement providing a full spray may be different for different modes. For example, in the above-described embodiment, the spray plates **36**,**38** may provide a full spray over a larger range of movement than the spray cartridges **42**,**44** or vice versa. The spray plates **36**,**38** may provide a full spray over the same range of movement or different ranges of movement. The spray cartridges **42**,**44** may provide a full spray over the same range of movement or different ranges of movement. A wide range of combinations can be achieved by appropriate configuration of the spray selection module **34**.

In the above-described embodiment, the spray head **32** is rotatable through 360° (degrees) in both clockwise and anticlockwise directions and is retained in any adjusted position by friction between the hub **34** and the diverters **86**,**88** under the biasing of the springs **94**,**96**. Any other means for retaining the spray head **32** in an adjusted position may be employed.

By providing four spray outlets with adjacent spray outlets at right angles, spray from the spray head **32** can be prevented from spraying in an upwards direction during changeover from one spray mode to another to prevent water spraying outside a shower area such as a shower enclosure or a bath. In particular, maximum flow from a selected spray outlet is achieved when the diverter ports **102** are aligned with the hub bore **78**,**80**,**82**,**84** associated with the selected spray outlet and is reduced as the spray outlet is rotated beyond the range of angular adjustment to change the spray mode thereby reducing the range of the spray generated by the reduced flow.

In the above-described embodiment, the spray head **32** has a first pair of spray outlets provided by the spray plates **36**,**38** and a second pair of spray outlets provided by the spray cartridges **42**,**44** that are normal to the first pair of spray outlets and both pairs of spray outlets are normal to the pivot axis of the spray head **32**.

As will be appreciated, in the above-described multi-mode handset, the spray head **32** is rotatable about a pivot axis transverse to the longitudinal axis (center line) of the handle portion **24** to select a desired spray mode and/or to change the direction of the spray for a selected spray mode. In a modification (not shown, the spray head **32** may be rotatable about a pivot axis parallel to the longitudinal axis (center line) of the handle portion **24**. Alternatively, the pivot axis of the spray head **32** may be located at a position intermediate these positions.

In another modification (not shown), the head portion **26** may be rotatable relative to the handle portion **24** about a pivot axis parallel to the longitudinal axis (center line) of the handle portion **24**. This may be in addition to the rotation of the spray head **32** relative to the head portion **26** as described above allowing the angular orientation of the spray head **32** to be adjusted about two axes.

In a further modification (not shown), one or preferably both of the spray plates **36**,**38** may be replaced by detachable spray cartridges releasably secured by any suitable means. In this way, any of the spray modes can be changed by selection and fitment of an appropriate spray cartridge allowing spray heads to be configured to provide any desired combination of spray modes. Where an outlet is provided by a spray cartridge, the spray cartridge itself may also be adjustable to provide more than one spray mode. Such spray cartridges are preferably detachable but may not be detachable or at least not readily detachable.

In the above-described embodiment, water is fed into the spray selection module **34** by means of two flow passageways feeding water into both ends of the module from a pair of spigots **28**,**30**. It is envisaged that an alternative embodiment may comprise a single water feed to the spray selection module from one of the spigots. In this alternative embodiment, the other spigot may be omitted. Similarly, in the above-described embodiment, the spray selection module has four ports for selecting four spray modes but this may be varied to provide more ports or fewer ports according to the number of spray modes without departing from the invention. For example, we may provide two spray modes comprising a spray outlet on one side of the spray head and another spray outlet in a side edge of the spray head substantially normal to each other and to the pivot axis of the spray head. We may provide three spray modes comprising a spray outlet on one side of the spray head and two spray outlets in a side edge of the spray head opposite one another and substantially normal to the spray outlet on one side with the spray outlets also normal to the pivot axis of the spray head. Alternatively, we may provide three spray modes comprising a spray outlet on each side of the spray head and a further spray outlet in a side edge of the spray head substantially normal to the spray outlets on each side with the spray outlets also normal to the pivot axis of the spray head. We may provide more than four spray modes. For example with may provide a spray head having more than four sides, for example, pentagonal, hexagonal etc, with a spray outlet in each side where the spray head is rotatable to select a spray outlet and/or to change the direction of the spray of the selected spray outlet.

An alternative spray selection module is shown in FIG. **17** and comprises a cylindrical element **156** associated with the spray head (not shown) and mounted for rotation on a cylindrical arm **150** that defines a pivot axis for the spray head and is in communication with the water supply passageway in the handset. The arm **150** is provided with an elongate port **152** extending longitudinally of the arm and is bounded by a sealing ring **154** that provides fluid-tight seal between the arm **150** and the element **156**.

The element **156** has a number of outlets provided as annular ports **160** on an outer face **162** of the cylinder. The ports **160** are offset relative to each other in the axial and/or circumferential direction to align selectively with the port **152** as the element **156** rotates to direct water flow through a selected port **160** to a corresponding spray outlet such as the nozzles or slot described previously. The ports **152** and **160** are configured so that port **152** does not overlap successive ports **160** when rotating element **156** to change the port **160** aligned with the port **152**. As a result, water flow is interrupted when changing over the flow path to select a different spray mode. In other respects, the operation of this embodiment to change the spray mode and/or the direction of spray will be understood from the description of the previous embodiment.

Referring now to FIG. **18**, there is shown a modification of FIG. **17** in which like reference numerals are used in to indicate corresponding parts. In FIG. **18**, the configuration of the ports **160** in the element **156** is changed from annular to elliptical so that port **152** overlaps successive ports when rotating the element **156** to change the port **160** aligned with the port **152**. As a result, water continues to flow when changing over the flow path to select a different spray mode. In other respects, the operation of this embodiment to change the spray mode and/or the direction of spray will be understood from the description of the previous embodiments.

Referring now to FIGS. **19** and **20**, there is shown another showerhead **170** embodying the invention. In this embodiment, the showerhead **170** comprises a cylindrical spray head **172** connected at one end to a water supply fitting **174** by means of a coupling pin (not shown) that allows rotation of the spray head **172** relative to the water supply fitting **174** about the longitudinal axis of the spray head **172**.

Internally, the spray head **172** is divided into four longitudinally extending chambers by partition walls (not shown) that separate the chambers. In this embodiment, the chambers are of equal size so that each chamber extends circumferentially over 90° (degrees) of the outer surface of the spray head **172**. It will be understood, however, that any number of chambers may be provided and that these may be of the same or different size.

A spray selector plate **176** is provided at the end of the spray head **172** that is secured to the water supply fitting **174**. The spray selector plate **176** has four circumferentially spaced ports **176***a*, **176***b*, **176***c*, **176***d*—one for each chamber—of generally elliptical shape offset from the rotational axis of the spray head **172**.

The water supply fitting **174** is connected to a flexible water supply hose **178** and is provided with an annular delivery port **174***a* offset from the rotational axis of the spray head **172**. In use, the spray head **172** is rotatable about its longitudinal axis relative to the water supply fitting **174** to align selectively the ports **176***a*, **176***b*, **176***c*, **176***d* with the annular delivery port **174***a* to supply water to the associated chamber.

Each chamber is provided with an array of openings in the outer surface of the spray head **172** through which water supplied to the chamber can be discharged to form a spray pattern according to the number, size, shape and pattern of the holes. Two arrays are shown in the drawings for the chambers provided with the ports **176***a*, **176***b*. One array consists of a plurality of rows of uniformly spaced annular holes **180***a* of equal size. The other array consists of a row of uniformly spaced annular holes **180***b* of equal size between two rows of uniformly spaced elongate holes **180***c* (slots) of equal size that alternate with annular holes **180***d* of smaller size than the holes **180***b*. The arrays will produce different spray patterns. The other chambers are provided with different arrays of openings to provide additional alternative spray patterns. Any size or shape of openings may be employed.

The delivery port **174***a* is sized to overlap any two adjacent ports **176***a*, **176***b*, **176***c*, **176***d* as the spray head **172** is rotated to ensure that water continues to flow when changing over from one spray type to another. In a modification (not shown), the ports **176***a*, **176***b*, **176***c*, **176***d* may be arranged so that the flow of water is cut-off when changing over from one spray type to another. As shown, the ports **176***a*, **176***b*, **176***c*, **176***d* are larger than the delivery port **174***a* and allow angular adjustment of the direction of flow of water discharged from the array of openings associated with each port **176***a*, **176***b*, **176***c*, **176***d*.

In this embodiment, the flexible hose **178** is self-supporting and can be configured to change the position of the spray head **172** to direct the water discharged from the selected array of holes as desired. This is not essential however and the spray head **172** and water delivery fitting **174** could form a handset for mounting in a parking socket similar to FIG. **1**. Alternatively, the spray head **172** and water delivery fitting **174** could form a fixed spray head for mounting on a wall.

Although the spray head **172** is cylindrical in this embodiment, it will be understood that spray heads having other shapes could be employed to operate in similar manner.

Referring now to FIGS. **21** to **28** another showerhead **190** is shown embodying the invention. In this embodiment, the showerhead **190** comprises an outer rectangular support frame **192** configured to be mounted in a rectangular opening in a wall, ceiling or similar surface and an inner rectangular spray head **194** mounted in the frame **192** on a pair of hollow spigots (not shown) for rotational movement about a pivot axis extending between opposed side edges of the spray head **194** mid-way between the ends of the spray head **194**. The showerhead **190** may be mounted so as to be substantially flush with the surrounding surface finish, for example a tiled surface, and the frame **192** may be of a size and shape similar to a tile. In a modification (not shown), the pivot axis may extend between the ends of the spray head **194**. In another modification (not shown) the support frame **192** and/or spray head **194** may have shapes other than rectangular, for example annular. The support frame **192** and spray head **194** may have the same or different shapes.

The spray head **194** is connected to a source (not shown) of temperature controlled water such as a mixing valve or instantaneous water heater via the spigots and a spray selection module (not shown) located within the spray head **194**. The spray head **194** is rotatable about the pivot axis to select one of four spray modes and to adjust the direction of the spray of the selected spray mode as described in more detail later. The arrangement of the spigots and spray selection module may be similar to that described previously for the embodiment of FIGS. **2** to **16**.

The spray head **194** is provided on one side with a spray plate **196** having an array of openings comprising uniformly spaced annular holes **198** of equal size arranged in a plurality of rows. On the other side the spray head **194** has a spray plate **200** with an array of openings comprising holes **202** of equal size arranged in four groups, one at each corner, with the holes **202** uniformly spaced in rows. The arrays produce different sprays. The spray head **194** is also provided at the ends with a pair of spray cartridges **204**,**206** in the side edges between the spray plates **196**,**200** that provide different sprays. In this embodiment, one of the spray cartridges **204** has a single slot **208** providing a curtain spray and the other spray cartridge **206** has a linear array of spray holes **210**—in this embodiment three spray holes although it will be understood the number of holes may be more or less than three and may be arranged in a linear array or any other array as desired. The spray cartridges **204**,**206** are preferably detachable as described previously.

FIG. **21** shows the spray head **194** with the spray mode corresponding to the array of holes **198** in the spray plate **196** selected. The spray head **194** is rotatable from the position shown in FIG. **21** through the intermediate position shown in FIG. **22** to the position shown in FIG. **23** with the spray mode corresponding to slot **208** in cartridge **204** selected. The spray head **194** is rotatable from the position shown in FIG. **23** through the intermediate position shown in FIG. **24** to the position shown in FIG. **25** with the spray mode corresponding to the array of holes **202** in the spray plate **200** selected. The spray head **194** is rotatable from the position shown in FIG. **25** through the intermediate position shown in FIG. **26** to the

position shown in FIG. **27** with the spray mode corresponding to spray holes **210** in cartridge **206** selected. The spray head **194** is rotatable from the position shown in FIG. **27** through the intermediate position shown in FIG. **28** to return to the position shown in FIG. **21** with the spray mode corresponding to the array of holes **198** in the spray plate **196** again selected. As will be appreciated, the spray head **194** can be rotated in either direction to select the desired spray mode. In this embodiment, the spray head **196** is rotatable through 90° (degrees) between each spray mode.

As with the embodiment of FIGS. **2** to **16**, the spray selection module is configured to allow the spray head **194** to be tilted in each spray mode to alter the angle at which the spray is discharged. Thus, the spray selection module permits a range of angular movement of the spray head **194** in the selected spray mode to alter the direction of the spray from the selected spray outlet to maintain a full spray without discharging water from any of the other spray outlets. If the spray head **194** is rotated beyond the permitted range of angular movement for a selected spray outlet, the spray selection module starts to deliver water to both the selected spray outlet and the next spray outlet in the direction of rotation of the spray head **194**. As a result, flow of water gradually decreases from the selected spray outlet and gradually increases from the next spray outlet in the direction of rotation until the spray head **194** is rotated sufficiently to position the spray head **194** within the permitted range of angular adjustment of the next spray outlet so that water is discharged from the next spray outlet only. In this way, the flow of water is not interrupted during changeover from one spray outlet to the next spray outlet and the showerhead can be used with instantaneous water heaters or combination boilers where a continuous flow of water is required to maintain safe operation.

The permitted range of angular movement over which the direction of spray from the spray outlet of a selected spray mode can be adjusted until water starts to be discharged from the next spray outlet may be of the order of 50° (degrees) to 80° (degrees), and preferably from 60° (degrees) to 75° (degrees) with a range of 65° (degrees) to 70° (degrees) most preferred. The range of movement either side of a center position (FIGS. **21**,**23**,**25**,**27**) may be the same, for example when the showerhead is mounted in the ceiling or may be different, for example when the showerhead is mounted in the wall. Thus, the showerhead may be mounted in the wall at different levels and the angular movement may be chosen to allow the user to adjust the position more to one side of the center position than the other side so as to direct the spray to different parts of the body according to the position of the showerhead in the wall. The spray head **194** is rotatable through 360° (degrees) in both clockwise and anti-clockwise directions and is retained in any adjusted position by friction or any other suitable means.

The multi-mode showerhead **190** of FIGS. **21** to **28** may include any of the modifications described previously in connection with the multi-mode handset of FIGS. **2** to **16** including, but not limited to a single water feed to the spray selection module from one of the spigots mounting the spray head. In this alternative embodiment, the other spigot may be omitted. Similarly, in the above-described embodiment, the spray selection module has four ports for selecting four spray modes but this may be varied to provide more ports or fewer ports according to the number of spray modes without departing from the invention. For example, we may provide two spray modes comprising a spray outlet on one side of the spray head and another spray outlet in a side edge of the spray head substantially normal to each other and to the pivot axis of the spray head. We may provide three spray modes comprising a spray outlet on one side of the spray head and two spray outlets in a side edge of the spray head opposite one another and substantially normal to the spray outlet on one side with the spray outlets also normal to the pivot axis of the spray head. Alternatively, we may provide three spray modes comprising a spray outlet on each side of the spray head and a further spray outlet in a side edge of the spray head substantially normal to the spray outlets on each side with the spray outlets also normal to the pivot axis of the spray head. We may provide more than four spray modes. For example with may provide a spray head having more than four sides, for example, pentagonal, hexagonal etc, with a spray outlet in each side where the spray head is rotatable to select a spray outlet and/or to change the direction of the selected spray.

One or more of the single showerheads of FIGS. **21** to **28** may be mounted in the wall or ceiling or other suitable surface. Alternatively or additionally, two or more spray heads may be mounted in a common support frame, for example side by side, providing a multiple showerhead for mounting in the wall and/or ceiling. The user can adjust individual or multiple showerheads to provide the same or different spray types.

In the above-described embodiments, the spray head is manually adjustable by the user to select the required spray mode and to adjust the direction of spray in the selected mode. For some applications, however, the user may find manual adjustment is difficult and/or time consuming.

For example, a ceiling mounted spray head may be out of reach of some users while adjusting multiple spray heads may be slow.

Referring now to FIGS. **29** to **32** another showerhead is shown embodying the invention that allows the user to adjust the spray head remotely.

As shown, the showerhead **300** is mounted in the ceiling **302** of the shower area although this is not essential and the showerhead could be mounted in the wall. The showerhead **300** is of annular shape comprising an annular outer spray head **304** and an annular inner spray head **306** mounted within a central opening **308** in the outer spray head **304**. The outer spray head **304** is fixed and the inner spray head **304** is mounted for rotational movement about a pivot axis to select one of four spray modes and/or to change the direction of spray of the selected spray mode. In a modification (not shown), the outer spray head **304** and/or inner spray head **306** may have shapes other than annular, for example rectangular. The outer spray head **304** and inner spray head **306** may have the same or different shapes. In another modification (not shown), the outer spray head **304** may be replaced by a support frame similar to the embodiment of FIGS. **21** to **28**.

In this embodiment, the showerhead **300** is supplied with temperature controlled water from a digital mixer valve **310** that can be located outside the shower area, for example in the ceiling. A user operable control interface **312** is mounted in the shower area on the wall **314** so as to be within reach of a user within the shower area. The control interface **312** includes suitable means for the user to select water temperature and optionally one or more other features such as flow rate, start and stop times, pause times as will be familiar to those skilled in the art.

The inner spray head **306** is rotatable by means of a stepper motor **316** and the control interface **312** includes means for the user to activate the stepper motor **316** via the power supply and control electronics (not shown) of the digital mixer valve **310** for the user to select the spray mode and/or to adjust the direction of spray in the selected spray mode. In a modification (not shown), the digital mixer valve may be replaced by another source of temperature controlled water and the step-

per motor **312** provided with a separate power source and control electronics for controlling the inner spray head **306** in response to user actuation of the control interface.

The outer spray head **304** has a plurality of spray holes arranged in three concentric rings **318**,**320**,**322** with the size or number of the holes increasing from the inner ring **318** to the outer ring **322**. This is not essential and the number, size and arrangement of the holes may be altered from that shown. The inner spray head **306** is similar to the spray head shown and described in FIGS. **2** to **16** and the construction of the inner spray head **306** to provide four spray modes as well as the modifications and changes that can be made to such spray head will be understood from the description of FIGS. **2** to **16**.

The control electronics may allow the user to control selectively the supply of water from the digital mixer valve **310** to the outer spray head **304** and inner spray head **306** via the control interface **312**. For example, the user may select supply of water to both spray heads **304**,**306** at the same time or to one spray head only—the inner or outer spray head. The user may be able to select different combinations and/or sequences for the supply of water to the spray heads **304**,**306**. For example, water may be supplied to both spray heads in response to selection of a spray mode corresponding to a spray plate on one side of the inner spray head **306** while water may be supplied to the inner spray head only in response to selection of a spray mode corresponding to a spray cartridge in a side edge of the inner spray head **306**. These are provided by way of non-limiting example only and all sequences and/or combinations of sprays that can be achieved are within the scope of the invention.

One suitable control interface **312** for use with the showerhead **300** is shown in FIG. **32** and comprises a control panel **324** provided with a rotatable knob **326** for user selection of the water temperature and an array of eight push buttons **328**,**330**,**332**,**334**,**336**,**338**,**340**,**342** for user selection and control of different functions of the showerhead. Push button **328** is an on/off button that may be used to pause the flow of water. Push buttons **330**,**332**,**334** control the flow rate and allow selection of three different flow rates, for example high, medium and low. Push buttons **336**,**338** control the direction of rotation of the inner spray head **306** when changing the spray mode by rotating the spray head **306** in clockwise or anticlockwise directions. The push buttons **336**,**338** may provide indexing movement of the inner showerhead **306** by activating the stepper motor to rotate the inner showerhead to the center position of the next spray mode in the selected direction of rotation for each actuation of the push button **336**,**338**. Alternatively, the stepper motor may be activated to rotate the inner spray head **306** only while the push button **336**,**338** is actuated. Push button **340** may provide adjustment of the angular position of the inner spray head **306** in the selected spray mode. Push button **342** may provide continuous sweeping movement of the inner spray head **306** back and forth over the permitted range of angular movement of the inner spray head **306** for the selected spray mode. These are examples only of the possible functions and the control panel **324** may include other buttons or knobs to control other functions of the showerhead.

In the previous embodiments, the spray selection module is configured so that water is discharged from one or more spray outlets throughout the range of rotational movement of the rotatable spray head, i.e. the flow of water is not interrupted by rotation of the spray head and the spray head can be used with sources of temperature controlled water requiring a continuous flow of water. In the embodiment of FIGS. **29** to **32**, however, it will be understood that supply of the water to the inner spray head **306** of the showerhead **300** can be interrupted in a selected spray mode and/or during changeover from one spray mode to another spray mode if the outer spray head **304** is supplied with water at the same time. For example, the water supply to the inner spray head **306** can be interrupted in a selected spray mode if the user selects the outer spray head **304** only or if the outer spray head **304** is supplied with water at all times. Alternatively or additionally, the water supply to the inner spray head **306** can be interrupted during changeover from one spray mode to another spray mode if the outer spray head **304** is provided with water at all times or if the outer spray head **304** is supplied with water in response to rotation of the inner spray head **306** beyond the permitted range in a selected spray mode so that water to the inner spray head **306** is interrupted. Such operation may be achieved via the control electronics.

As will be appreciated the motorized embodiment of FIGS. **29** to **32** is particularly suited to installations in which the showerhead is located in a position where manual rotation of the spray head by certain users may be prevented or inhibited. It is also beneficial to installations having a plurality of rotatable spray heads arranged individually in separate showerheads or grouped together in a single showerhead by allowing the user to control each spray head independently of the other spray heads or in combination with one or more other spray heads of the same or another showerhead.

In the previous manually operable embodiments of the invention, the water supply to the rotatable spray head is uninterrupted for all angularly adjusted positions of the spray head. It will be understood however, that the water flow can be interrupted if the showerhead is provided with a spray outlet that, in use, is supplied with water at all times irrespective of the position of the rotatable spray head and/or in response to rotation of the rotatable spray head to changeover the selected spray mode. For example, in the embodiment of FIGS. **2** to **16** the head portion **26** of the showerhead **20** may be provided with an outlet such as one or more holes through which water can flow at all times. Similarly, in the embodiment of FIGS. **21** to **28**, the support frame **192** may be provided with an outlet such as one or more holes through which water can flow at all times. Where provided, the outlet in the head portion **26** or support frame **192** preferably comprises a plurality of holes that extend around substantially the entire perimeter of the rotatable spray head. FIGS. **33** and **34** show a modification of the handset of FIGS. **2** to **16** for this purpose where the head portion **26** is provided with a plurality of holes **108** that extend around substantially the entire perimeter of the rotatable spray head **32** through which water can flow at all times irrespective of the position of the spray head **32**. In this arrangement, flow of water through the spray head **32** can be interrupted during changeover between spray modes while still providing water flow through the holes **108**. Alternatively, flow of water may be provided through spray head **32** and the holes **108** at all times.

In a modification (not shown) flow of water through the holes **108** may be controlled so as to be provided during changeover between spray modes only when flow of water through the spray head **32** is interrupted and to be interrupted in a selected spray mode when flow of water through the spray head **32** is permitted. In another modification (not shown), flow of water through the holes **108** may be provided during changeover between spray modes and in a selected spray mode. For example, flow of water through the holes **108** may be provided during changeover between spray modes when flow of water from the spray head **32** is interrupted and with flow of water through the spray plates **36** or **38** but not with flow of water through the spray cartridges **42**,**44**.

Referring now to FIGS. **35** and **36**, a fixed showerhead **400** according to another embodiment of the invention is shown. In this embodiment, the showerhead **400** has a body **402** for mounting on a support surface such as a wall (not shown) and a rotatable spray head **404**. The spray head **404** is similar to the spray head **32** described previously in connection with FIGS. **2** to **16** and the construction and operation including modifications thereto will be understood from the description of FIGS. **2** to **16** and modifications thereof.

In this embodiment, the body **402** is fixed to the support surface and has an inlet (not shown) for connection to a water supply pipe (not shown). The inlet may be accessible from the rear of the body for concealed connection to the water supply pipe through the support surface.

Alternatively, the body **402** may have an inlet for connection to a rising or falling surface mounted supply pipe. The body **402** may be a casting or machining of metal or alloy. Alternatively, the body **402** may be a plastics moulding with an appropriate surface finish.

The body **402** is provided with a hollow support arm **406** having an annular, ring-shaped head portion **408** with a pair of opposed, inwardly directed hollow spigots **410**,**412** on which the spray head **404** is mounted for rotation about a pivot axis to select a desired spray mode and/or to adjust the inclination of the spray head **404** in the selected spray mode as described previously for the spray head of FIGS. **2** to **16**.

In this embodiment, the support arm **406** is formed from a hollow pipe or tube bent to the required shape. The ends of the pipe are connected to the body **402** and are in fluid communication with the inlet to deliver water to the spray head **404**. As shown the support arm **406** is generally V-shaped in side elevation so that the head portion **408** is spaced from the body **402** and is inclined at an angle of approximately 45° (degrees) to the support surface such that, in a selected spray mode, water is discharged from the spray head **404** in a downwards direction away from the support surface. It will be understood that the inclination of the head portion **406** may be altered to suit the requirements of a particular installation.

The head portion **408** may be provided with holes similar to the holes **108** in the head portion **26** of the showerhead **32** shown in FIGS. **33** and **34**.

Where provided, the holes in the head portion **408** may perform the same function as the holes **108** and will be understood from the description of FIGS. **33** and **34** and modifications thereof.

In the above-described embodiments, flow of water from the spray head may be uninterrupted during changeover between spray modes due to the overlap between the spray modes provided by the spray selection module, This may result in the spray being directed towards areas outside the normal spray area, particularly behind the spray head. In order to confine the spray during changeover without interruption of the flow, the showerhead may be provided with means for diverting the spray so that it remains within the normal spray area. Such means may be provided by configuring the head portion to prevent the spray escaping to areas outside the normal spray area during the changeover. FIG. **37** shows a modification to the handset of FIGS. **2** to **16** for this purpose where the head portion **28** is modified to enclose parts of the spray head **32** that face rearwardly in any selected spray mode and during changeover between spray modes. In this way, the spray head is prevented from spraying in a rearwards direction, especially during changeover between spray modes. Any other means for diverting the spray so as to confine the spray within a desired area may be employed. A similar feature may be provided in the other embodiments of the showerhead described herein.

In the above-described embodiments, the spray direction is transverse to the pivot axis in each spray mode and this could result in the spray head being subjected to a force tending to rotate the spray head from its set position. This is potentially a problem for manual versions of the showerhead if the force exceeds the frictional force holding the showerhead in its set position. For this reason, the spray outlets of the rotatable spray head are preferably arranged symmetrically with respect to the pivot axis so that flow of water from the spray head in each mode is balanced and forces tending to rotate the spray head from its set position are eliminated or significantly reduced. A symmetrical arrangement of the spray outlets may not be necessary where the frictional force holding the spray head in its set position is large or for powered versions of the showerhead where movement of the spray head is controlled by a motor.

While the invention has been described with what are currently the best modes known to the applicant, it will be understood that we do not intend to be limited thereto. In particular, where appropriate or the context permits, features of the embodiments are interchangeable and features of any of the embodiments may be employed separately or in combination with features of any of the other embodiments.

What is claimed is:

1. A showerhead, comprising:

a support having an outlet; and

a spray head rotatably mounted to the support, the spray head being configured to:

rotate about a single pivot axis,

select any one of a plurality of spray modes angularly spaced apart in a direction of rotation, and

adjust a direction of spray discharged from the spray head at the selected spray mode;

wherein a flow of water received by the spray head during changeover between spray modes is uninterrupted such that the spray discharged from the spray head is continuous.

2. The shower head of claim **1**, wherein the spray head includes a diverter port and a hub that is rotatable relative to the diverter port in response to rotation of the spray head, the diverter port is in fluid communication with the outlet, and the hub comprises an opening associated with each spray mode.

3. The shower head of claim **2**, wherein the opening associated with an adjacent spray mode is configured to overlap the diverter port before the opening associated with the selected spray mode clears the diverter port, such that the flow of water is uninterrupted during changeover between spray modes.

4. The showerhead of claim **1**, wherein the direction of the spray at a selected spray mode is transverse to the pivot axis.

5. The showerhead of claim **1**, wherein the spray head has at least two spray modes.

6. The showerhead of claim **1**, wherein the spray head includes a spray selection module configured to direct the flow of water to a spray discharge of the selected spray mode.

7. The showerhead of claim **1**, wherein the spray head includes a spray mode with a spray discharge comprising a plurality of openings in a spray plate.

8. The showerhead of claim **1**, wherein the spray head includes at least one spray mode with a spray discharge comprising a single opening.

9. The showerhead of claim **1**, wherein the spray head includes at least one spray mode provided by a detachable spray cartridge.

10. The showerhead of claim **1**, wherein the spray head is rotatable through 360°.

11. The showerhead of claim 1, wherein the spray head is angularly adjustable in each spray mode through an arc including a center position of the selected spray mode to change the spray direction in the selected spray mode.

12. The showerhead of claim 11, wherein the spray head is angularly adjustable to either side of the center position.

13. The showerhead of claim 12, wherein the support extends around a marginal edge of the spray head.

14. A showerhead, comprising:

a support; and

a spray head rotatably mounted to the support, the spray head being configured to:

rotate about a single pivot axis,

select any one of a plurality of spray modes angularly spaced apart in a direction of rotation of the spray head, and

adjust a direction of spray discharged from the spray head at the selected spray mode;

wherein a flow of water received by the spray head is uninterrupted during changeover between spray modes such that a continuous flow of water is maintained;

wherein the support includes an outlet separate from the spray head; and

wherein a flow of water is provided through the outlet when changing from one spray mode to another spray mode.

15. The showerhead of claim 14, wherein the outlet comprises a plurality of openings spaced apart in the support, and wherein the support extends around a marginal edge of the spray head.

16. The showerhead of claim 14, wherein the support includes a hollow body configured to deliver a flow of water to the spray head.

17. A showerhead, comprising:

a spray head configured to:

receive a flow of water,

rotate about a single pivot axis,

select any one of a plurality of spray modes angularly spaced apart in a direction of rotation, and

adjust a direction of spray discharged from the spray head at the selected spray mode;

wherein the spray discharged from the spray head during changeover between spray modes is confined within a desired spray area; and

wherein full spray is maintained while rotating the spray head to change the direction of spray for a selected spray mode within a range of angular movement.

18. The showerhead of claim 17, wherein the range of angular movement to provide full spray is between about 50 degrees and about 80 degrees.

19. The showerhead of claim 17, wherein the spray head is configured to select any one of at least three spray modes.

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